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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/814,023

03/20/2001

Lynn Cai

NTI-006

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04/22/2004

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EXAMINER

AZARIAN, SEYED H

ART UNIT

PAPER NUMBER

2625

DATE MAILED: 04/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/814,023

Applicant(s)

CAI ET AL.

Examiner

Seyed Azarian

Art Unit

2625

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 13 February 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-70 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 13-17, 22-27, 35-43 and 48-58 is/are allowed.
- 6) ☒ Claim(s) 1-3, 5, 6, 18-21, 28, 44-47, 59-70 is/are rejected.
- 7) ☒ Claim(s) 4, 7-12 and 29-34 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 March 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 2, 3, 4, 5, 6
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_

**DETAILED ACTION**

**Claim Rejections - 35 USC § 102**

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

Claims 1-3, 5-6, 18-21, 28, 44-47 and 59-70 are rejected under 35 U.S.C. 102(e) as being anticipated by Pang et al (U.S. patent 6,578,188).

Regarding claim 1, Pang discloses a method of providing printability analysis for a defect on a physical mask, the method comprising;

generating a simulated wafer image of the physical mask (column 7, line 58 through column 8, line 14, capturing the image to simulate the wafer for mask inspection);

generating a simulated wafer image of a reference mask (column 8, line 15-25, each defect can be performed using a model);

the reference mask corresponding to a defect-free physical mask (Fig. 6, column 15, line 20-35, using reference to be free from defect);

identifying a first feature proximate to the defect on the simulated wafer image of the physical mask (Fig. 1 and 2, column 2, lines 28-44, features of defect on the area of the mask);

identifying a second feature on the simulated wafer image of the reference mask, the second feature corresponding to the first feature (Fig. 1 and 2, is illustrated in the flowchart of Fig. 3, column 2, lines 58 through column 3, line 18, inspecting a mask to identify different defects on the physical mask);

and computing critical dimension deviation including the first and second features to provide the printability analysis (Fig. 10 (a) column 20, lines 14-31, define the range of between the curves and represents the range of defocus and exposure deviation).

Regarding claim 2, Pang discloses the method of claim 1, wherein comparing includes determining a first critical dimension of the first feature and a second critical dimension of the second feature (Fig. 19, column 24, line 47 through column 25, line 6, determining critical dimension in different window).

Regarding claim 3, Pang discloses the method of claim 2, wherein comparing includes calculating a relative critical dimension deviation for the first and second features (Fig. 10, column 20, lines 33-50, computing deviation between two area).

Regarding claim 5, Pang discloses the method of Claim 3, further including; identifying a first plurality of features proximate to the defect on the simulated wafer image of the physical mask; identifying a second plurality of features on the simulated wafer image of the reference mask, the second plurality of features corresponding to the first plurality of features; and calculating a plurality of relative critical dimension deviations for the first and second plurality of features (see claim 1, also Fig. 19, column 24, line 47 through column 25, line 6, determining critical dimension in different window).

Regarding claim 6, Pang discloses the method of claim 5, further including determining the largest of the plurality of relative critical dimension deviations, thereby providing a maximum critical dimension deviation (Fig. 19, column 24, line 47 through column 25, line 6, the CD (critical dimension) value of each of the three area falls within the upper (maximum) and lower CD band).

Regarding claim 18, Pang discloses a method of providing printability analysis for a defect on a physical mask, the method comprising: generating a simulated wafer image of the physical mask; identifying a first feature on the simulated wafer image affected by the defect; identifying a second feature on the simulated wafer image unaffected by the defect, wherein the first and second features have substantially the same critical dimension in the absence of the defect; and comparing the first and second features (see claim 1, and column 24, line 47 through column 25, line 6, computing critical dimension for different area, an area with no defect 1902 (defect-free), and defect area 1904).

Regarding claim 19, Pang discloses the method of claim 18, further including determining a tolerance for critical dimension changes (Fig. 1 and 2, column 2, line 58 through column 3, line 17, determining the tolerance).

Regarding claim 20, Pang discloses the method of claim 19, wherein using the tolerance for critical dimension changes to provide the printability analysis (Fig. 18, column 24, lines 36-45, print such small defect using tolerance scale).

Regarding claim 21, Pang discloses the method of claim 19, wherein using includes determining the number of exposures (column 17, lines 8-22, number of exposures).

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Regarding claim 44, Pang discloses a physical mask comprising, at least one defect being modified based on a first average critical dimension deviation and a first maximum critical dimension deviation provided from analyzing a simulated wafer image of the physical mask and a simulated wafer image of a reference mask, the reference mask corresponding to a defect free physical mask (Fig. 19, column 24, line 47 through column 25, line 6, the CD (critical dimension) value of each of the three area falls within the upper (maximum) and lower CD band, also Fig. 9, column 18, lines 46-64 defect free design layout of physical mask).

Regarding claim 46, Pang discloses a physical mask comprising: at least one feature being modified based on a first average critical dimension deviation and a first maximum critical dimension deviation provided by comparing a simulated wafer image of the physical mask and a simulated wafer image of a reference mask, the reference mask corresponding to a defect-free physical mask (see claim 44, and Fig. 17, column 23, line 64 through column 24, line 21 the simulated wafer exposure of the mask and comparison).

Regarding claim 59, Pang discloses a physical mask comprising, at least one defect being unmodified based on a first average critical dimension deviation and a first maximum critical dimension deviation provided from analyzing a simulated wafer image of the physical mask and a simulated wafer image of the reference mask, the reference mask corresponding to a defect-free physical mask (Fig. 19, column 24, line 47 through column 25, line 6, the CD (critical dimension) value of each of the three area falls within the upper (maximum) and lower CD band, also Fig. 9, column 18, lines 46-64 defect free design layout of physical mask).

Regarding claim 28, it recites similar limitation as claim 1 is similarly analyzed.

Regarding claims 45-47 and 59-70, it recites similar limitation as claims 1, 44 and 46 are similarly analyzed.

### **Claim Rejections - 35 USC § 103**

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claim 4, is rejected under 35 U.S.C. 103(a) as being unpatentable over Pang et al (U.S. patent 6,578,188).

Pang discloses substantially the claimed invention as set forth in the discussion above for claim 1, see Fig. 2.

Pang does not disclose expressly "subtracting the second critical dimension from the first critical dimension, and dividing a resulting value by the second critical dimension".

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At the time of the invention, it would have been obvious to one having ordinary skill in the art to subtracting the second critical dimension from the first critical dimension, and dividing a resulting value by the second critical dimension. Applicant has not disclosed that subtracting the second critical dimension from the first critical dimension, and dividing a resulting value by the second critical dimension provides an advantage, is used for a particular purpose or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform equally well with either the critical dimension taught by Pang or the claimed subtracting the second critical dimension from the first critical dimension, and dividing a resulting value by the second critical dimension, because both define the range of between the curves and represents the range of defocus and exposure deviation to determine the sensitivity of the acceptable lithography conditions to variations in the parameters affecting the lithography process.

Therefore, it would have been obvious to combine to one of ordinary skill in this art to modify Pang with to obtain the invention as specified in claim 4.

### Allowable Subject Matter

4. Claims 7-12 and 29-34, are objected as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitation of the base claim and any intervening claims.



### Allowable claims

5. Claims 13-17, 22-27, 35-43 and 48-58 are allowable.

The following is an examiner's statement of reasons for allowance.

The claim 13, is allowable due to the computing an average critical dimension deviation for a defect-free area of the physical mask using the simulated wafer images of the physical and reference masks, computing a maximum critical dimension deviation for a defect area of the physical mask using the simulated wafer images of the physical and reference masks to provide the printability analysis.

The closest prior art of record (Pang) teaches the method and apparatus for a network-based mask defect printability analysis system. But does not teach or suggest using the average critical dimension deviation and the maximum critical dimension deviation to provide the printability analysis.

These key features in combination with other features of the claimed invention are neither taught nor suggested by the art of record.

Claims 22, 35, 48, 49 and 53, recites substantial very similar limitations as claim 13 above and is allowed for the same reason.

### Other prior art cited

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. patent (5,825,647) to Tsudaka is cited for correction method and correction apparatus of mask pattern.

U.S. patent (5,326,659) to Liu et al is cited for method for making masks.

U.S. patent (5,572,598) to Wihl et al is cited for automated photomask inspection apparatus.

U.S. patent (6,272,392) to Capodieci is cited for methodology for extracting effective lens aberrations using a neural network.

U.S. patent (5,965,306) to Mansfield et al is cited for method of determining the printability of photomask defects .

### **Contact Information**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Seyed Azarian whose telephone number is (703) 306-5907. The examiner can normally be reached on Monday through Thursday from 6:00 a.m. to 7:30 p.m.

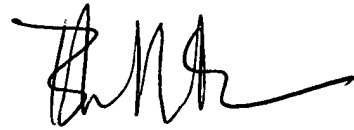
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta, can be reached at (703) 308-5246. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application information Retrieval (PAIR) system. Status information for published application may be obtained from either Private PAIR or Public PAIR.

Status information about the PAIR system, see [http:// pair-direct.uspto.gov](http://pair-direct.uspto.gov). Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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A handwritten signature in black ink, appearing to read 'B. Mehta', with a long horizontal stroke extending to the right.

**BHAVESH M. MEHTA**  
**SUPERVISORY PATENT EXAMINER**  
**TECHNOLOGY CENTER 2600**

*Seyed Azarian*  
*Patent Examiner*  
*Group Art Unit 2625*  
March 31, 2004